

It's About Time!

An MT Tour of WWV

By Wayne Heinen

Photographs by Joan Heinen

As we approach the town of Wellington, Colorado, just north of the city of Fort Collins and head north on I-25, a rather large antenna farm becomes visible off to the west. Turning west on the county road we are soon at a driveway sporting a metal sign: "National Institute of Standards & Technology, Frequency-Time Broadcast Service Radio Stations WWVB - WWV." We follow the dirt road another half mile before arriving at the station buildings and antennas.

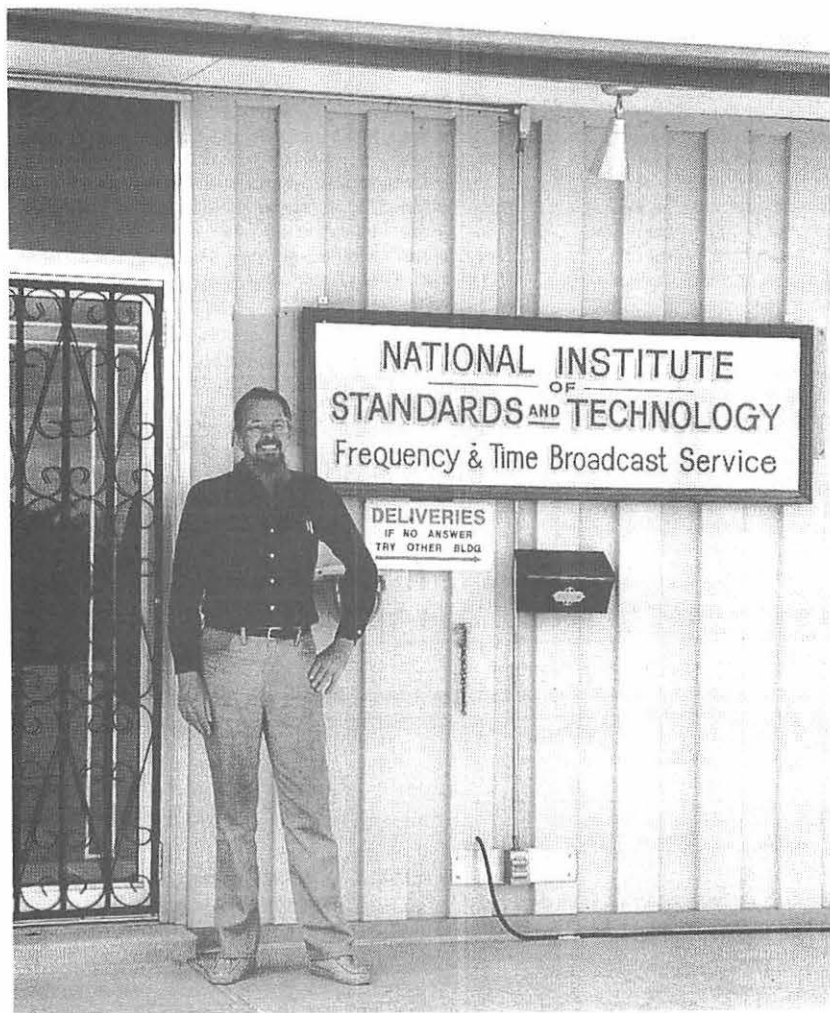
WWV occupies 390 acres on the plains just to the east of the foothills which lead to the Rocky Mountains. Director Jim Maxton greets us at the WWVB building, which houses the 13 kW transmitters for WWVB along with some of the timing equipment.

Calculating the Time

Our tour starts with a basic overview of how WWV arrives at the correct time. This process is a lot more complicated than one might think. Each morning a reading is taken from the GPS (Global Positioning System) navigation satellite and is compared to a small cesium clock in Boulder, Colorado. Simultaneously, the same operation is performed at the Fort Collins transmitter site on one of their reference clocks. These readings measure the differences between the reference clocks. Using a complicated mathematical formula, the difference between the WWV reference clock and UTC is then determined.

At one time a system called the line ten transfer system was used. In this older system, a reading was taken on the leading edge of the tenth line of a particular TV station's horizontal sweep. This was done simultaneously in Boulder and Fort Collins, and the differences between the leading edge of the horizontal sweep was compared to the pulse of the clocks in both locations. This gave the difference between the two clocks in Boulder and Fort Collins which then could be used to calculate the difference between the reference clocks and UTC.

The new GPS antenna is a helical enclosed in a small plastic bubble at the top of a mast on the WWVB building. The Yagi that was used in



WWV/WWVB Director Jim Maxton
in front of the WWVB building.

divided by 'Time Code Generators' in order to provide the proper RF frequency for each of the transmitters—2.5, 5, 10, 15 and 20 MHz—that WWV operates on. The audio tones and the time ticks are all derived from the cesium clocks. The time code generators control all of the audio portion—the tones, time ticks and time announcements."

The voice message console is where the voice recordings are made. The weather announcements, geo-alerts and all other announcements are phoned in and recorded on the appropriate tape. The time code generator knows what minute it is and switches on the appropriate tape. During the 18th minute, we all get to hear the A Index, K Index and solar flux which are used to predict propagation.

It was a surprise to find the old drum recorder with the voice of Don Elliott Heald still operating at the time of our tour. The new time code generators that were installed about a year ago have the new digitized voices that you hear. Many people are unhappy with the new voice of the digitized system. Jim Maxton assures us that a another new voice is going to be used and the digitized messages will be rerecorded by an announcer named John Doyle. After being treated to a preview, we agree that Mr Doyle's voice will be very pleasant to hear over WWV.

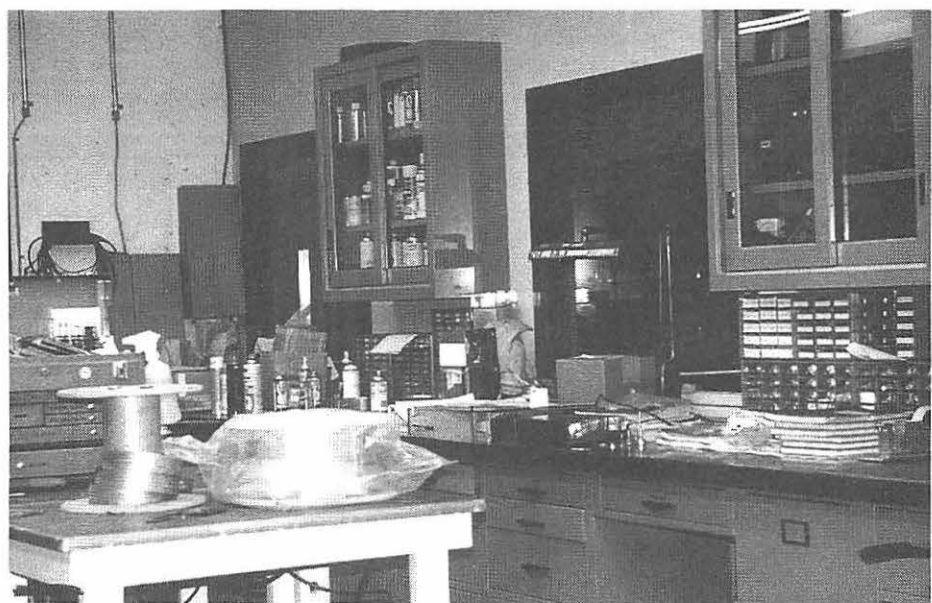
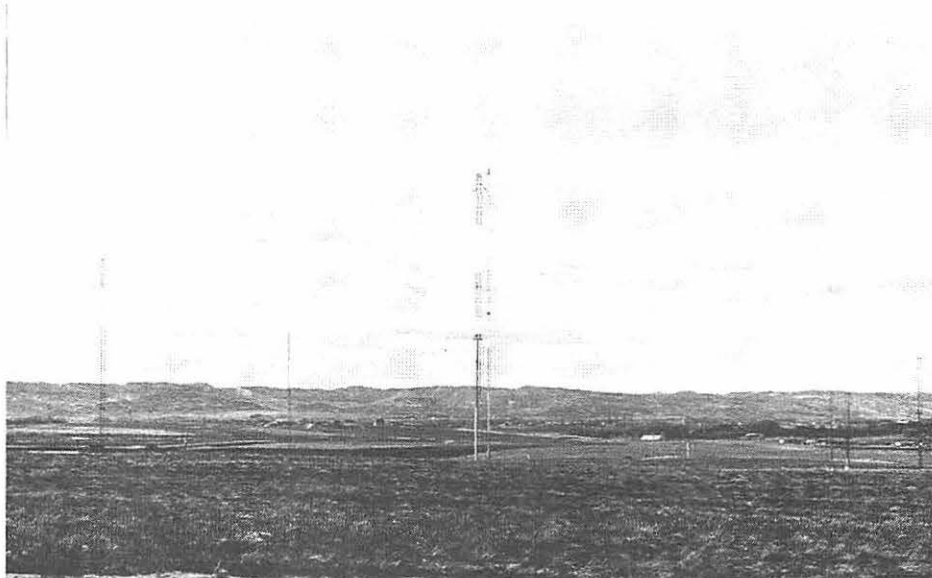
The mention of WWV going to Daylight time a month earlier than they should have (see "Communications," May '92 MT) was due to an error in programming of the new Time Code Generators. "It was an error in entry. Unfortunately, there is no display of the program that's currently running," was Director Maxton's comment.

Next we view the WWV transmitters. Each frequency has one on-line and one standby transmitter. The new on-line transmitters run Class C operation, while the old transmitters ran Class AB. The more efficient Class C transmitters really help out the electric bill. Prior to their use, WWV ran an average of \$10,000 a month for electricity; now the bill is around \$7000. The transmitters are in a hallway that completely surrounds the shop. Outside of that hallway is another hallway. This allows access to the rear of the transmitters for repair. A full color schematic diagram of the transmitter's circuitry hangs on the wall.

Through the second hallway we are led to the power distribution area. This is also where the backup generator is located. If power fails, WWV and WWVB will continue to broadcast, as both have separate backup generators.

A View of the Farm

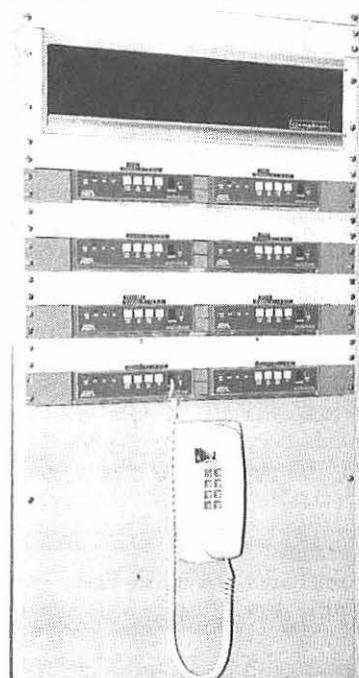
Now we turn to the "antenna farm" for WWV. Each transmitter feeds a separate 1/4 wave vertical antenna. WWV employs two



Top: Antennas and back-up antennas for the several frequencies used by WWV/WWVB make an impressive antenna farm on this high Colorado plain.

Middle: In the center of the building is the WWV repair shop.

Right: The various voice announcements are phoned in and recorded for automatic playback on the correct minute.

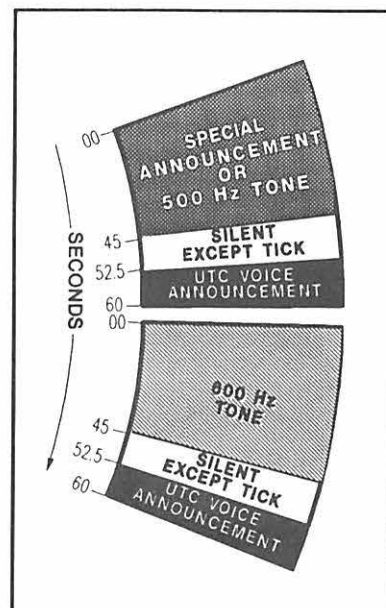
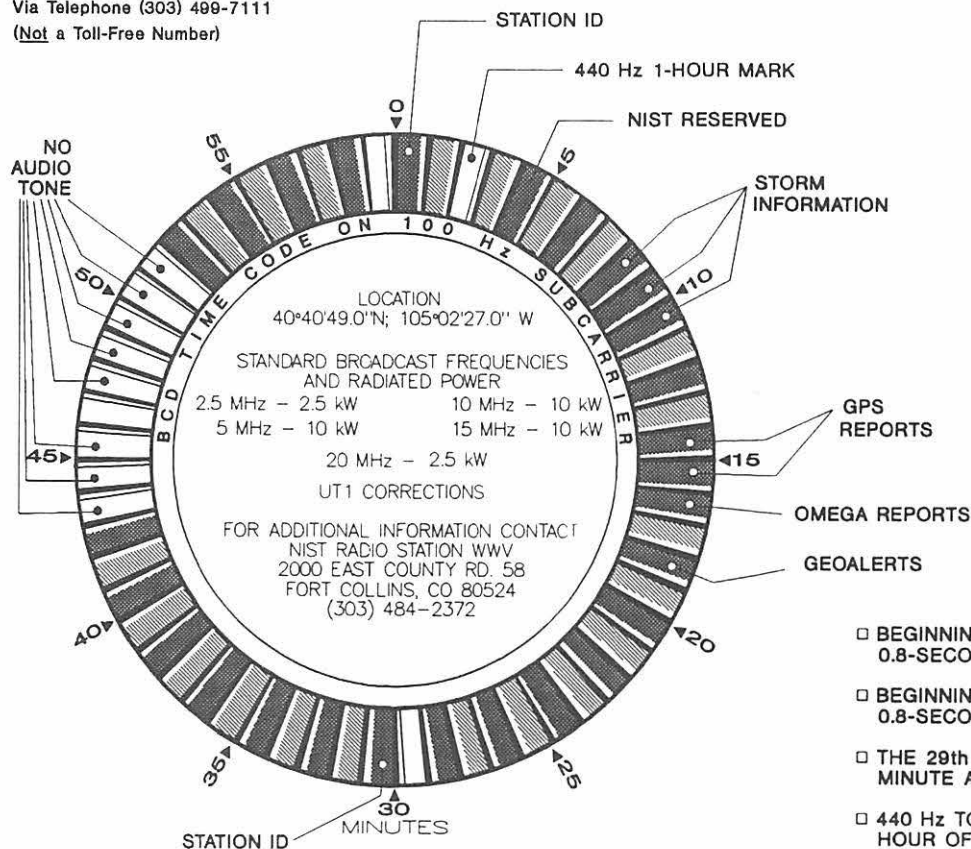


WWV

Broadcast Format

Via Telephone (303) 499-7111

(Not a Toll-Free Number)



- BEGINNING OF EACH HOUR IS IDENTIFIED BY 0.8-SECOND-LONG, 1500-Hz TONE.
- BEGINNING OF EACH MINUTE IS IDENTIFIED BY 0.8-SECOND-LONG, 1000-Hz TONE.
- THE 29th AND 59th SECOND PULSES OF EACH MINUTE ARE OMITTED.
- 440 Hz TONE IS OMITTED DURING FIRST HOUR OF EACH DAY.

wideband backup towers for the five frequencies.

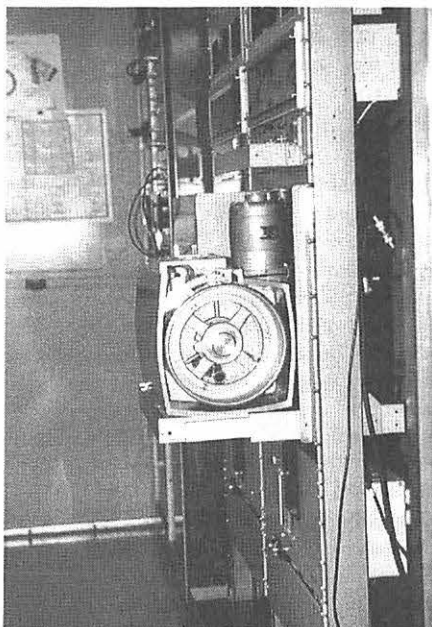
Walking out the rear of the building, we climb a small flight of stairs to an observation platform. There we get a good view of all seven of the towers that are used, as well as the feed lines that are mounted a foot off the ground.

WWVB has a large top loaded antenna system consisting of four towers in a diamond formation and a backup of the same size. This is best seen from the road.

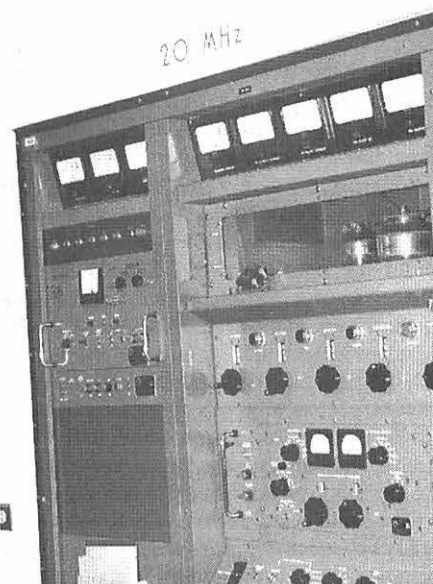
Walking back through the WWV facility, we spy the QSL board in the front hall. This board sports ham and SWL cards from signal receptions around the world.

We express our thanks for *MT's* specially-arranged tour of WWV. Sadly, WWV and WWVB are unable to accommodate tours due to the lack of personnel. They do, however, have a publication which is available for the asking that explains about WWV, WWVB, WWVH and the services that they provide. The chart in our sidebar is from the book and shows a WWV "Hour" and a WWV "Minute." Their address is in the middle of the "Hour." When writing, request NIST Special Publication 432, and let them know that you enjoyed *MT's* special tour of the station. *M_T*

Wayne Heinen is a veteran radio hobbyist who serves on the Board of Directors of the National Radio Club, is licensed amateur radio operator N0POH and is Police Beat editor for the National Scanning Report.



The drum recorder with the voice of Don Elliott Heald was seeing its last days at the time of our visit.



There was an on-line transmitter and a back-up for each frequency—2.5, 5, 10 and 20 MHz. Pictured is the on-line transmitter for 20 MHz.